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Abstract

We assess whether the adoption of inflation targeting (IT) frameworks has facilitated countercyclical monetary policies in a sample of 90 industrial and developing economies, 22 of which have adopted IT. Using propensity score matching methods, we show that the average treatment effect of IT has a statistically significant and quantitatively quite large effect in facilitating a more countercyclical monetary policy in IT adopting countries.

JEL classification: E4, E5

Keywords: Inflation targeting, monetary policy cyclicality, treatment effect, propensity score matching

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1. Introduction

It is well documented that many—mainly developing—economies pursue procyclical macroeconomic policies that amplify the business cycle. Particular attention has been paid to the cyclical nature of fiscal policy in developing economies, with ample evidence that this typically has been procyclical (e.g., Alesina, Campante, and Tabellini 2008). The recent literature relating to the cyclicality of monetary policy arrives at broadly similar conclusions—that is, monetary policy also is generally countercyclical in industrial economies and procyclical in developing economies with tentative evidence of a transition to countercyclical monetary policy in some of the latter (Frankel 2011; McGettingham, Moriyama, Ntsama, Painchard, Qu and Steinberg, 2013; Vegh and Vuletin 2013).[1] In this paper, we expand the empirical literature on the determinants of monetary policy cyclicality by examining the role of monetary regimes. Specifically, we look at whether the adoption of an inflation targeting (IT) regime has facilitated the procyclicality of monetary policy by evaluating the treatment effect of IT on monetary policy cyclicality using propensity score-matching methods, which have the advantage of avoiding the 'self-selection problem' of policy adoption that can give rise to biased results.

There are several reasons for believing that adoption of an IT regime could facilitate procyclical monetary policy. The first and probably most important reason is the potential impact of IT on monetary policy credibility: adopting a single mandate such as IT can be an effective way for a central bank that cannot commit to overcome the classic time-inconsistency problem. Policy credibility should be enhanced by the rules-based approach of IT and its emphasis on transparency and accountability relative to other monetary frameworks. Recent research suggests that IT adoption has positive credibility effects, for example, as measured by subsequent developments in government borrowing costs (Palomino, 2012; Thornton and Vasilakis 2016). Second, the exchange rate flexibility inherent in IT should reduce the sensitivity of interest rates in so far as it provides a mechanism for the correction of external imbalances not available with an exchange rate peg (Jahjah, Wei, and Yue 2013). Third, the adoption of IT may signal a commitment to economic reforms and sounder macroeconomic policies (Roger 2010). Finally, because of the constraint that an IT framework imposes on seigniorage revenues, IT adoption could result in better fiscal discipline and fiscal reforms that boost fiscal revenue and contain spending (Minea and Tapsoba 2014).[2]

Formal empirical evidence on the impact of IT on the cyclicality of monetary policy appears to be limited to McGettingham, Moriyama, Ntsama, Painchard, Qu, and Steinberg (2013). They apply panel regression techniques to 64 developing and high-income countries during the period 1985-2011 and report that countries that have adopted an IT framework tend to have more countercyclical monetary policy—that is, they find an improvement in the correlation coefficient between real interest rates and output in these countries. A drawback of this study is that it ignores the self-selection problem of policy adoption that arises when a country's targeting choice is nonrandom and can lead to biased estimates. In particular, systematic correlation between the targeting choice and other covariates will cause the selection-on-observables problem, which can lead to biased estimates. We find evidence for the existence of this problem with an IT dummy in probit estimates being systematically correlated with variables such as macroeconomic performance, the level of public debt, the level of financial development, and the exchange rate regime. To address the self-selection problem, we evaluate the treatment effect of IT on monetary policy cyclicality making use of propensity score-matching methods. Our results indicate that IT has reduced procyclicality by about 11 per cent of the correlation between the cyclical components of output and real interest rates.

2. Methodology

We test the impact of IT adoption on the cyclicality of monetary policy by examining developments in a 10-year rolling window correlation between the cyclical component of real GDP and the cyclical component of the real short-term interest rate, where the latter is our proxy for the stance of monetary policy.[3] A positive correlation is indicative of countercyclical monetary policy, while a negative correlation indicates procyclical monetary policy. The treatment group comprises 22 advanced and developing economies that had adopted IT by the end of 2014. We draw on Hammond (2012) for a listing of countries that adopted IT and for the adoption dates. The control group comprises 68 non-IT countries for which we could access data on interest rates and the different control variables. 10-year rolling window correlations between the cyclical components of real interest rates and real GDP for the IT and non-IT countries are shown in Table 1.[4] The table shows the average correlation for the pre- and post-IT periods for the inflation targeting countries, and for pre- and post-1999 for the non-IT countries, with 1999 chosen simply because this is the mean year of IT adoption by the inflation targeting countries. In both IT and non-IT countries, monetary policy became more countercyclical on average (i.e., the correlation coefficients increased). Annual developments in the average rolling correlation coefficients for IT and non-IT countries are shown in Figure 1. Again, there appears to be little to choose between their experiences, with convergence in the average correlation coefficients after 2007 and suggestions of more procyclical policies during the 2007-2009 financial crisis and more countercyclical policies thereafter.

We make use of four propensity score-matching methods that have been applied recently to macroeconomic policy evaluations (e.g., Glick, Guo, and Hutchinson 2006, Lin and Ye 2007, 2009). The first is the nearest-neighbour matching with replacement, which matches each treated country to the N control countries that have the closest propensity scores. We employ two nearest-neighbour matching estimators: n = 1 and n = 3. The second method is radius matching, which performs the matching based on estimated propensity scores falling with a certain radius R. We use a wide radius (r=0.05), a medium radius (r=0.03), and a tight radius (r=0.01). The third method is the kernel matching method, which matches a treated group country to all control group countries weighted in proportion to the closeness between the treated group country and the control group country. The fourth method is the regression adjusted local linear matching method.

3. Estimating the average treatment effects

We first estimate the propensity scores using a probit model in which the probability of adopting an IT framework is conditional on a group of control variables:

$$P(Y_{it} = 1|X_{it} = \phi(X'_{it}\beta) + \eta_{it} \tag{1}$$

where Y_{it} is a 0,1 dummy variable for the adoption of an IT regime (where 1 indicates IT adoption), X_{it} is a set of control variables, ϕ is the cumulative function of the standard normal distribution, and η_{it} is the error term. We then utilize the estimated propensity scores to conduct matching to obtain the treatment effects of IT adoption. For the independent variables, we draw on Samarina and de Haan's (2014) analysis of the determinants of a country's decision to adopt an IT framework. Their findings suggest that countries are more likely to adopt IT if they have low inflation, high real GDP growth, a flexible exchange rate regime, are more integrated into the world economy, have a history of fiscal discipline, and have more developed financial markets. Accordingly, the dependent variables in our baseline probit model are: the lagged inflation rate, real GDP growth, the ratios to GDP of public debt, foreign trade, and bank credit to the private sector. In addition, we employ the Chinn and Ito (2006) financial openness index, and a measure of exchange rate regime flexibility, for which we use the Reinhart and Rogoff (2004) course grid classification system. The macroeconomic variables are from the World Bank's World Development Indicators database, and we draw on Abbas, Belhocine, El Ganainy, and Horton (2010) and the IMF's World Economic Outlook database for data on public debt. The results from the probit model are reported in Table 2. The baseline result in column 1 of the table broadly supports the Samarina and de Haan (2014) analysis—that is, IT adoption is more likely in countries that have relatively high rates of GDP growth, relatively low levels of inflation and public debt, are more integrated into the global economy through open trade and capital accounts, and have more flexible exchange rate regimes and relatively deep financial markets.

To ensure greater comparability between the treatment group and the control group, we discard the control group countries whose estimated propensity scores are lower than the lowest score among the treatment group countries. The matching results are presented in Table 3, which reports the estimated average treatment effect on the treated (ATTs) of monetary policy cyclicality. The baseline results are in the first row of the table and show that the ATTs are positive, highly statistically significant, and quite large in magnitude at about 11% of the correlation coefficient. That is, the correlation between the cyclical components of monetary policy (real interest rates) and real GDP rises following the adoption of an IT framework, which we interpret as reflecting a fall in the procyclicality of monetary policy.

We carry out three tests to check the robustness of our finding that IT significantly reduces monetary policy procyclicality in IT-adopting countries. First, we take into account that many countries in the sample (inflation-targeters and non-targeters) experienced financial crises during the period, which likely impacted on the conduct of monetary policy and could bias our results. The probit estimate including a financial crisis dummy is reported in the second column of Table 2. The coefficient on the crisis dummy is not statistically significant, and the associated ATTs reported in the second row of Table 3 remain of the same sign, statistically significant, and of a similar magnitude as the baseline result. Second, to avoid the suspicion that very high rates of inflation in some countries might be driving the results, we dropped high-inflation (above 100 percent) countries from the sample. These probit results are reported in column 3 of Table 2 and are comparable to those for the full sample of countries. The associated ATTs are reported in row 3 of Table 3 and also are largely unchanged in terms of sign, size and statistical significance. Finally, we examine the sensitivity of our results to the country composition of the sample by splitting the sample into industrial and developing economies on the grounds that the latter tend to have had a more volatile experience with respect to output and inflation and they might be expected to face greater difficulty in managing the technical challenges of implementing an IT framework. The probit results for industrial and developing countries are reported in columns 4 and 5 of Table 2, respectively. The main differences between the two sets of countries are that GDP growth and open capital accounts levels are not statistically significant factors in the decision by industrial countries of whether or not to adopt an IT framework, and that developing economies are less likely to adopt IT if they have experienced a financial crisis. The associated ATTs are reported in rows 4 and 5 of Table 3 and remain in line with the baseline estimate for the full sample of countries. That is, the adoption of an IT framework appears to reduce the procyclicality of monetary policy in both industrial and developing countries.[5]

4. Conclusions

In this paper, we evaluated the treatment effect of IT on the cyclicality of monetary policy in industrial and developing economies. We used propensity score matching methods to show that the average treatment effect of IT on increasing the counter-cyclicality of monetary policy is statistically significant and quantitatively quite large in IT countries. On average, the adoption of IT has led to a rise in the correlation coefficient between the cyclical components of monetary policy and real GDP of about 11 per cent. This result is robust to controlling for the effects of financial crises and removing high-inflation countries from the sample, and appears to be valid for both industrial and developing country IT adopters.

Footnotes

1. Recent work suggests that greater counter cyclicality might be transmitted by the effects of monetary and macroeconomic policy announcements on liquidity flows (e.g., Chordia, Sarkar, and Subrahmanyam 2005; Sensoy 2016) or a pass-through from treasury bills to private yields (Kiley 2016).

2. Of course, not all the evidence is that IT adoption is beneficial. For example, Ball and Sheridan (2005) find no evidence that economic performance (measured by the behavior of inflation, output, and interest rates) improved in adopting countries relative to non-adopting countries in a sample of OECD countries; and Thornton (2016) reports that adoption of an IT did not help reduce inflation and growth volatility in developing countries compared to the average experience with other monetary regimes, and was no more advantageous in these regards than the adoption of a hard or crawling peg exchange rate regime.

3. See McGettingham, Moriyama, Ntsama, Painchard, Qu and Steinberg, 2013; and Vegh and Vuletin 2013 for similar approaches to measuring the cyclicality of monetary policy.

4. The real interest rate is measured as the average interest rate less the average rate of consumer price inflation; interest rates are mainly central bank discount rates (from the IMF's International Financial Statistics database) because of their longer availability, though in some cases we have data for overnight interbank interest rates. The cyclical components of interest rates and GDP are derived from the average of the estimated trend in each series using a HP filter with lambda 100 and 6.25.

5. At the suggestion of a referee, we also employed an alternative probit model for the probability of adopting an IT framework as the basis estimating the propensity scores, using the 'monetary independence index' (MI index) calculated by Aizenman, Chinn and Ito (2008) in place of the exchange rate regime and financial openness indicators In the probit estimate, the coefficient on the MI index is positive and statistically significant, indicating that IT adoption is more likely in countries with more monetary independence; and the corresponding matching results do not differ substantially from those reported in Table 3. (Results available on request.)

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TABLE 1
TEN-YEAR MOVING CORRELATION COEFFICIENTS BETWEEN THE CYCLICAL COMPONENTS OF THE REAL INTEREST RATE AND REAL GDP, 1979-2014

Inflation targeting countries					Non-inflation targeting countries			
	Year inflation targeting adopted	Pre-inflation targeting period	Post-inflation targeting period	Change		Pre-1999	Post-1999	Change
Australia	1993	0.181	0.012	-0.169	Algeria	0.084	-0.173	-0.256
Brazil	1999	0.039	-0.383	-0.422	Antigua and Barbuda	0.115	0.222	0.107
Canada	1991	0.188	0.391	0.203	Argentina	0.005	0.086	0.081
Chile	1999	0.688	0.357	-0.331	Austria	0.155	0.391	0.236
Colombia	1999	0.297	0.656	0.359	Bahrain	0.169	-0.333	-0.503
Ghana	1992	0.233	0.173	-0.060	Bangladesh	0.054	0.098	0.044
Hungary	2007	-0.040	-0.009	0.031	Barbados	-0.468	0.017	0.485
Iceland	2001	0.529	0.821	0.292	Belgium	0.541	0.454	-0.087
Indonesia	2005	0.253	0.176	-0.077	Belize	0.169	-0.333	-0.503
Israel	2001	-0.020	0.275	0.295	Benin	0.186	0.351	0.165
Korea	1997	0.033	0.337	0.304	Bolivia	0.033	-0.162	-0.195
Sri Lanka	1998	0.052	0.127	0.075	Botswana	-0.019	0.072	0.091
Mexico	1995	0.297	0.419	0.122	Bulgaria	0.053	-0.337	-0.390
New Zealand	2001	-0.148	0.554	0.702	Burkina Faso	0.260	0.061	-0.199
Norway	2001	0.292	0.369	0.077	Burundi	-0.138	-0.164	-0.026
Peru	1989	0.240	0.727	0.487	Cameroon	-0.194	0.338	0.532
Philippines	2002	-0.028	0.235	0.263	Central African Republic	-0.021	0.207	0.228
South Africa	2002	0.369	0.294	-0.075	Chad	-0.271	0.058	0.329
Sweden	1995	0.085	-0.112	-0.196	China	-0.105	0.539	0.643
Thailand	2006	0.100	0.088	-0.012	Congo, Rep.	0.119	0.144	0.025
Turkey	2000	0.114	0.270	0.156	Costa Rica	0.348	0.004	-0.344
United Kingdom	2000	-0.425	-0.133	0.292	Cote d'Ivoire	-0.107	0.515	0.622
					Dominica	-0.280	-0.378	-0.098
					Egypt	0.014	0.082	0.069
					Fiji	0.004	0.248	0.243
					Finland	-0.447	-0.219	0.228
					France	0.012	0.583	0.570
					Gabon	-0.336	-0.113	0.223
					The Gambia	0.022	-0.087	-0.109
					Germany	0.559	0.298	-0.262
					Greece	-0.144	0.081	0.225
					Grenada	-0.303	-0.472	-0.169
					Guinea-Bissau	0.106	-0.229	-0.335
					Guyana	0.183	0.485	0.302
					India	0.260	-0.104	-0.365
					Ireland	0.017	-0.268	-0.285
					Italy	0.028	0.493	0.465
					Japan	0.063	-0.569	-0.632
					Jordan	0.730	0.111	-0.619
					Kenya	0.005	0.488	0.483
					Madagascar	0.047	0.267	0.220
					Malawi	0.065	0.074	0.010
					Malaysia	-0.083	0.026	0.109
					Mali	0.243	0.011	-0.232
					Mauritania	0.310	0.211	-0.099
					Mauritius	-0.223	0.276	0.499
					Morocco	0.086	-0.098	-0.184
					Netherlands	0.600	0.283	-0.317
					Nepal	-0.006	0.284	0.289
					Niger	0.183	0.061	-0.121
					Nigeria	0.278	-0.309	-0.587
					Pakistan	-0.365	-0.118	0.247
					Papua New Guinea	-0.007	0.009	0.015
					Portugal	0.251	0.060	-0.190
					Senegal	0.326	-0.106	-0.432
					Seychelles	0.203	-0.357	-0.560
					Sierra Leone	-0.083	0.424	0.507
					Singapore	-0.078	0.008	0.086
					Spain	-0.047	0.401	0.448
					Switzerland	-0.152	0.414	0.566
					Togo	0.125	0.414	0.290
					Trinidad and Tobago	0.091	0.154	0.062
					Tunisia	0.191	-0.044	-0.236
					Uganda	0.339	-0.227	-0.566
					United States	-0.029	0.397	0.426
					Uruguay	-0.227	-0.171	0.056
					Venezuela	0.202	0.468	0.266
					Zambia	-0.144	0.267	0.411
Mean		0.151	0.257	0.105	Mean	0.052	0.082	0.030

Notes
Correlation coefficients are 10-year moving averages of annual data. For non-inflation targeting countries the pre- and post-inflation targeting periods are pre- and post-1999, which is the mean (and median) year of inflation targeting adoption by adopting countries. The cyclical components have been estimated using the Hodrick-Prescott Filter. A positive (negative) correlation indicates countercyclical (procyclical) monetary policy.